FPS-001
Fingerprint Sweep Identification Module
User's Guide

Introduction Fingerprint Sweep

1. Function characteristics

- Compact design
- High-accuracy and high-speed identification technology
- Simple host interface protocol by UART
- 1:N & 1:1 matching
- Adjustable identification threshold.
- Low power consumption
- No high frequency part on main board

2. Technical Specifications

Parameters	Value
Enrollment capability	40
Image Zone	232Pixel * 324Pixel
Image Resolution	600DPI
Pixel gray scale values	256
Swipe speed	4.5cm/s
Enroll mode	Three or one time
Identification time	Less than 0.9S
Template size	400Byte
Match mode	1：1 verify or 1：N identify
Threshold control	1~5 Level
False-Rejection-Rate (FRR)	0.1%, If Threshold is 3
False-Acceptance-Rate (FAR)	0.001%, If Threshold is 3
Interface	Serial UART 19200bps
Dimension of Processor board	51mm x 36mm x 10mm
Dimension of Sensor	18.2mm x 4.8mm x 2.75mm
Resistant to Abrasion	Large than 1 Million Finger Sweeps
ESD protection	> 15kV
Supply voltage	5VDC
Supply current	Active：150mA
Operating temperature	-10℃ ~ 65℃
Operating humidity	20% - 90%
Storage temperature	-20℃ ~80℃
Storage humidity	20% - 90%

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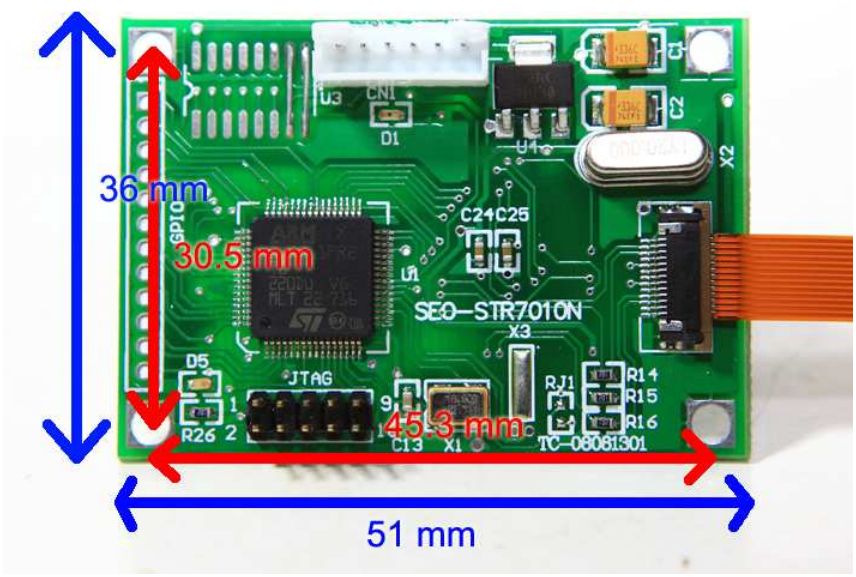
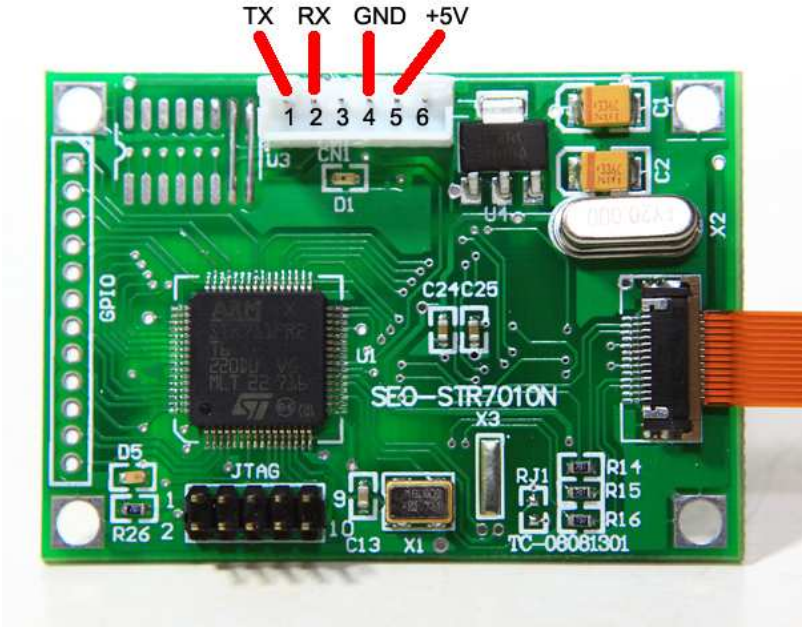
3. Match board Element Layout



4. Module connector

CON	Pin	Definition	Note
CN1	Pin1	TTL-TX	TTL Uart Output of module transmit
	Pin2	TTL-Rx	TTL Uart Input Input of module receive
	Pin3	Reset	When restarting system, input low-level pulse to this pin
	Pin4	GND	GND
	Pin5	5VDC	DC 5V power input
	Pin6	N/C	Not Use



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Communication Protocol

1. Communication Method

The module is used as a slave device. The Master device sends relative commands to control it. The CMD sent by the master and the ACK signal returned by the module.

Command interface: UART (Universal Asynchronous Receiver Transmitter)

19200bps 1 start-bit 1 stop-bit (no check bit)

2. Command Packet

CMD	LEN	DAT	CHK
2byte	2byte	LEN byte	1byte

Offset	Item	Size (byte)	Description
0	CMD	2	Command Code
1	LEN	2	Length of Data
2	DAT	LEN	LEN=0 (No Data)，DAT = Data
3	CHK	1	Check Sum is the low byte of value listed below offset[0] + offset[1] + offset[2] For Example : CMD=0101h (2 bytes) ,LEN=0001h (2 bytes) ,DAT=02h CHK=01h+01h+00h+01h+02h=05h

3. Response Packet

RCM	LEN	DAT	CHK
2byte	2byte	LEN byte	1byte

Offset	Item	Size (byte)	Description
0	RCM	2	Response Code
1	LEN	2	Data Length
2	DAT	LEN	Command Process Result Data. LEN=0 (No Data)，DAT = Data
3	CKS	1	Check Sum is the low byte of value listed below offset[0] + offset[1] + offset[2] RCM=0101h (2 bytes) ,LEN=0001h (2 bytes) ,DAT=02h CHK=01h+01h+00h+01h+02h=05h

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4. Command & Response List

No	Function	Command			Response		
		CMD	LEN	DAT	RCM	LEN	DAT
1	Verify	0101h	0001h	Template No.	0101h	0002h	Template No.+Result
2	Identify	0102h	0000h	-	0102h	0002h	Template No.+Result
3	Enroll	0103h	0001h	Template No.	0103h	0002h	Template No.+Result
4	Enroll One Time	0104h	0001h	Template No.	0104h	0002h	Template No.+Result
5	Clear Template	0105h	0001h	Template No.	0105h	0002h	Template No.+Result
6	Clear All Template	0106h	0001h	Template No.	0106h	0002h	Template No.+Result
7	Get Empty ID	0107h	0000h	-	0107h	0001h	Result
8	Get Template Status	0108h	0001h	Template No.	0108h	0002h	Template No.+Result
9	Get Broken Template	0109h	0000h	-	0109h	0002h	Total Broken Template + Template No.
10	Read Template	010Ah	0001h	Template No.	010Ah	0002h / 0193h	Template No.+Result / + Template Data
11	Write Template	010Bh	0193h	Template No, Template Data	010Bh	0002h	Template No.+Result
12	Set Security Level	010Ch	0001h	Value	010Ch	0001h	Result
13	Get Security Level	010Dh	0000h	-	010Dh	0001h	Security Level Value
14	Set Time Out	010Eh	0001h	Value	010Eh	0001h	Result
15	Get Time Out	010Fh	0000h	-	010Fh	0001h	Time Out Value
16	Set Device ID	0110h	000Ah	Device ID Code	0110h	0001h	Result
17	Get Device ID	0111h	0000h	-	0111h	000Ah	Device ID Code
18	Get F/W Version	0112h	0000h	-	0112h	0001h	F/W Version
19	Finger Detect	0113h	0000h	-	0113h	0004h	Result
20	FP Cancel	0114h	0000h	-	0114h	0001h	Result
21	Incorrect Command	-	-	-	0160h	0000h	-

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5. Command Description

The communication commands between the host and the module is following

Host ----------Command------→ module

Host ←-- --Response Result ----module

5.1 Verify (CMD: 0x0101)

[Function]: One to one match

Verify the designate template to live scanning finger, then response result.

At anytime the "FpCancel" Command will stop the process

[Command]

CMD	0x0101
LEN	0x0001
DAT	User ID, must be valued in the scope of 0 to 39
CHK	

[Response]

RCM	0101h			
LEN	0002h			
DAT	DAT1	User ID		
	DAT2	Result		Description
		0x00	Reject	Verification failure
		0x01	Accept	Successful verification.
		0x02	Time Out	Image capturing time out
		0x03	Bad Quality Image	bad quality image, no enough feature to verify
		0x05	Too Small Lines	Image is too small, get no enough minutiae, cannot verify
		0x06	Empty Template	There is no fingerprint data with user ID
		0xFF	Invalid Template Number	ID is out of the range of enrollment.
CHK				

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5.2 Identify (CMD: 0x0102)

[Function]: One to many match

The live scanning finger match to all templates in FLASH memory, then response result.

The flow reference Appendix 2

At anytime the "FpCancel" Command will stop the process

[Command]

CMD	0x0102
LEN	0x0000
CHK	

Note: no data area

[Response]

RCM	0102h			
LEN	0002h			
DAT	DAT1	The identified fingerprint data ID		
	DAT2	Result		Description
		0x00	Reject	Identification failure. There is no identified fingerprint data.
		0x01	Accept	Successful identification. The identified fingerprint data ID is returned
		0x02	Time Out	Image capturing time out
		0x03	Bad Quality Image	bad quality image, no enough feature to verify
		0x05	Too Small Lines	Image is too small, get no enough minutiae, cannot verify
		0x06	All Template Empty	Fingerprint Database is empty
CHK				

5.3 Enroll (CMD: 0x0103)

[Function]

In the process of enroll, User's finger must be put on the image reader for sweep 3 times, each time module get template temporary and storage in RAM, if the three template is correct, the module generalize the three template to one template then write to Flash memory.

At anytime the "FpCancel" Command will stop the process.

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[Command]

CMD	0x0103
LEN	0x0001
DAT	User ID, must be valued in the scope of 0 to 39
CHK	

[Response]

<table>
<tr><td>RCM</td><td colspan="4">0x0103</td></tr>
<tr><td>LEN</td><td colspan="4">0x0002</td></tr>
<tr><td rowspan="16">DAT</td><td>DAT1</td><td colspan="3">Enrollment ID or
Duplication ID if result code “Duplication”</td></tr>
<tr><td>DAT2</td><td colspan="2">Result</td><td>Description</td></tr>
<tr><td rowspan="15"></td><td>0x00</td><td>Fail Generalize</td><td>Generalize template fail</td></tr>
<tr><td>0x01</td><td>Success</td><td>Get the third fingerprint data when three fingerprints are enrolled, then Enroll the fingerprint template data by compounding first, second and third fingerprint data as a result of successful Enrollment</td></tr>
<tr><td>0x02</td><td>Time Out</td><td>No finger press on sensor, time out</td></tr>
<tr><td>0x03</td><td>Bad Quality Image</td><td>Fingerprint image quality is bad</td></tr>
<tr><td>0x04</td><td>Too Fast</td><td>Sweep too fast</td></tr>
<tr><td>0x05</td><td>Too Small Lines</td><td>Image is too small, get no enough minutiae</td></tr>
<tr><td>0x06</td><td>Second Sweep</td><td>Get first fingerprint data when three fingerprints are enrolled.
Waiting for the second sweep</td></tr>
<tr><td>0x07</td><td>Sweep One More</td><td>Get second fingerprint data when three fingerprints are enrolled.
Waiting for the third sweep</td></tr>
<tr><td>0xA1</td><td>Sweep First</td><td>Enroll command have received, waiting for the first sweep</td></tr>
<tr><td>0xA2</td><td>Duplication</td><td>Inspection of duplicated fingerprint is performed, and when the same finger is already enrolled, duplicated fingerprint is not enrolled and causes enrollment failure.</td></tr>
<tr><td>0x08</td><td>Not Empty</td><td>The user ID already existed</td></tr>
<tr><td>0xFF</td><td>Invalid Template Number</td><td>User ID is out of the range of enrollment</td></tr>
<tr><td>0xA0</td><td>Flash Writing Error</td><td>Writing error in enrollment database</td></tr>
<tr><td>CHK</td><td colspan="4"></td></tr>
</table>

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5.4 Enroll one time (CMD: 0x0104)

In the process of enroll one time, User's finger only put on the image reader for sweep one times.

[Command]

CMD	0x0104
LEN	0x0001
DAT	User ID ,must be valued in the scope of 0 to 39
CHK	

[Response]

<table>
<tr><td>RCM</td><td colspan="4">0x0104</td></tr>
<tr><td>LEN</td><td colspan="4">0x0002</td></tr>
<tr><td rowspan="11">DAT</td><td>DAT1</td><td colspan="3">Enrollment ID or
Duplication ID if result code “Duplication”</td></tr>
<tr><td rowspan="10">2byte</td><td colspan="2">Result</td><td>Description</td></tr>
<tr><td>0x01</td><td>Success</td><td>Successful Enrollment</td></tr>
<tr><td>0x02</td><td>Time Out</td><td>No finger press on sensor, time out</td></tr>
<tr><td>0x03</td><td>Bad Quality Image</td><td>Fingerprint image quality is bad</td></tr>
<tr><td>0x04</td><td>Too Fast</td><td>Sweep too fast</td></tr>
<tr><td>0x05</td><td>Too Small Lines</td><td>Image is too small, get no enough minutiae</td></tr>
<tr><td>0xA2</td><td>Duplication</td><td>Inspection of duplicated fingerprint is performed, and when the same finger is already enrolled, duplicated fingerprint is not enrolled and causes enrollment failure.</td></tr>
<tr><td>0x08</td><td>Not Empty</td><td>The user ID already existed</td></tr>
<tr><td>0xFF</td><td>Invalid Template Number</td><td>User ID is out of the range of enrollment</td></tr>
<tr><td>0xA0</td><td>Flash Writing Error</td><td>Writing error in enrollment database</td></tr>
</table>

5.5 Clear Template (CMD: 0x0105)

Delete fingerprint data with specified ID from database, immediately after this command is executed, fingerprint data with specified ID are deleted.

[Command]

CMD	0105h
LEN	0001h
DAT	Specified user ID which are deleted
CHK	

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[Response]

RCM	0105h			
LEN	0002h			
DAT	DAT1	The user ID are deleted		
	DAT2	Result		Description
		0x00	Already Empty	fingerprint data with specified ID already empty
		0x01	Clear Success	Delete Success
		0xFF	Invalid Template Number	User ID is out of the range
		0xA0	Flash Writing Error	Flash Writing Error
CHK				

5.6 Clear All Template (CMD: 0x0106)

Delete all fingerprint data in database, immediately after this command is executed, all fingerprint data in database are deleted.

[Command]

CMD	0106h
LEN	0000h
CHK	

[Response]

RCM	0106h			
LEN	0001h			
DAT	1byte	Result		Description
		0x01	Success	Success
		0xA0	Flash Writing Error	Flash Writing Error
CHK				

5.7 Get Empty ID (CMD: 0x0107)

Get the first pointer which points to blank area that storage fingerprint template

[Command]

CMD	0107h
LEN	0000h
CHK	

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[Response]

RCM	0107h			
LEN	0001h			
DAT	1byte	Result		Description
		0x01	Template No.	The first user ID that can be useable
		0xFF	Invalid Template Number	Database is full, no useable ID
CHK				

5.8 Get Template Status (CMD: 0x0108)

Check whether fingerprint data are enrolled in specified ID or not

[Command]

CMD	0108h
LEN	0001h
DAT	specified ID need checking, must be valued in the scope of 0 to 39
CHK	

[Response]

RCM	0108h			
LEN	0002h			
DAT	DAT1	The user ID that have check		
	DAT2	Result		Description
		0x00	Empty	There is no fingerprint data with specified ID
		0x01	Not Empty	Fingerprint data are enrolled in specified ID
		0xFF	Invalid Template Number	User ID is out of the range
CHK				

5.9 Get Broken Template (CMD: 0x0109)

Check fingerprint template Database is damage or not, although Database damage is unlikely.

[Command]

CMD	0109h
LEN	0000h
CHK	

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[Response]

RCM	0109h		
LEN	0002h		
DAT	DAT1	total number of template that damage	
		0	Database is integrity, no damage
		1-40	total number of template that damage
	DAT2	When DAT1>1, DAT2= the minimum number of ID No.	
CHK			

5.10 Read Template (CMD: 0x010Aa)

Read fingerprint data with specified ID from the module

[Command]

CMD	010Ah
LEN	0001h
DAT	User ID to be read, must be valued in the scope of 0 to 39
CHK	

[Response]

RCM	010Ah			
LEN	0193h / 0002h			
DAT	DAT1	Fingerprint data ID to be read		
	DAT2	Result		Description
		0x00	Empty	There is no fingerprint data with specified ID
		0x01	Valid	The user ID is valid
		0xFF	Invalid Template Number	User ID is out of the range
	DAT3	When LEN=0x0002 no DAT3 When LEN=0x0193 DAT3 is 401 bytes which Template Data		
CHK				

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5.11 Write Template (CMD: 0x010b)

Download fingerprint data with specified ID from host to module, then write to fingerprint template Database.

[Command]

CMD	010Bh	
LEN	0518h	
DAT	DAT1	specified ID to write
	DAT2	Template Data (402 byte)
CHK		

[Response]

RCM	010Bh			
LEN	0002h			
DAT	DAT1	specified ID to write		
	DAT2	Result		Description
		0x00	Incorrect Template	Template Data is incorrect
		0x01	Success	Write success
		0xFF	Invalid Template Number	User ID is out of the range
		0xA0	Flash Writing Error	Flash Writing Error

5.12 Set Security Level (CMD: 0x010c)

Set up threshold of fingerprint identification engine. Integer of 1-5 can be selected, 1 is the lowest identification level and 5 is the highest identification level. Default is 3

[Command]

CMD	010Ch				
LEN	0001h				
DAT	1byte	Security Level		FMR	FNMR
		1	Security Level 1	1 / 10000	8.3/10000
		2	Security Level 2	3 / 100000	9.4/10000
		3	Security Level 3(Default)	1 / 100000	1/1000
		4	Security Level 4	1 / 1000000	1.2/1000
		5	Security Level 5	1 / 10000000	1.3/1000
CHK					

FMR=False Match Rate
Alternative to 'False Acceptance Rate'.
FNMR=False Non-Match Rate
Alternative to 'False Rejection Rate'.

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[Response]

RCM	010Ch			
LEN	0001h			
DAT	1byte	Result		Description
		0x01	Success	Setup success
		0xFF	Invalid Security Level	Security Level is invalid
		0xA0	Flash Writing Error	Flash Writing Error
CHK				

5.13 Get Security Level (CMD: 0x010d)

[Command]

CMD	010Dh
LEN	0000h
CHK	

[Response]

RCM	010Dh			
LEN	0001h			
DAT	1byte	Result		Description
		1-5	Security level	Security Level in module
		0xA0	Flash Error	Read Flash error
CHK				

5.14 Set Time Out (CMD: 0x010e)

Update image capturing time out, in the process of execute "Verify", "Identify", "Enroll", "Enroll One Time" command. Integer of 1-10S can be selected

[Command]

CMD	010Eh			
LEN	0001h			
DAT	1byte	Time Out		Description
		1 – 10	Time Out = 1-10s	Integer of 1-10S can be selected
CHK				

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[Response]

RCM	010Eh			
LEN	0001h			
DAT	1byte	Result		Description
		0x01	Success	Update success
		0xFF	Invalid Value	The value is out of the range
		0xA0	Flash Writing Error	Flash Writing Error
CHK				

5.15 Get Time Out (CMD: 0x010f)

[Command]

CMD	010Fh
LEN	0000h
CHK	

[Response]

RCM	010Fh			
LEN	0001h			
DAT	1byte	Result		Description
		1-10	Value of Time Out	Initial value
		0xA0	Flash Error	Read Flash error
CHK				

5.16 Set Device ID (CMD: 0x0110)

Change Product ID of a product. The maker can write own Product ID in Flash memory, and can identify the product by this ID.

[Command]

CMD	0110h
LEN	000Ah
DAT	Device ID Code, 10 bytes
CHK	

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[Response]

RCM	0110h			
LEN	0001h			
DAT	1byte	Result		Description
		0x01	Success	Setup success
		0xA0	Flash Writing Error	Flash Writing Error
CHK				

5.17 Get Device ID (CMD: 0x0111)

[Command]

CMD	0111h
LEN	0000h
CHK	

[Response]

RCM	0111h		
LEN	000Ah		
DAT	10 byte	Result	Description
		Device ID Code	Device ID Code in module
CHK			

5.18 Get F/W Version

Get version of firmware

[Command]

CMD	0112h
LEN	0000h
CHK	

[Response]

RCM	0112h	
LEN	0002h	
DAT	Result	
	1byte	Major
	2 byte	Minor
CHK		

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5.19 Finger Detect

Checks whether the finger is placed on the sensor or not

[Command]

COM	0113h
LEN	0000h
CHK	

[Response]

RCM	0113h			
LEN	0001h			
DAT	1byte	Result		Description
		0x00	No Detect	No finger on sensor
		0x01	Detect finger	There is a finger on sensor

5.20 FP Cancel (CMD: 0x0114)

Terminate the process of all fingerprint operation as "Verify", "Identify", "Enroll", "Enroll One Time"

[Command]

CMD	0114h
LEN	0000h
CHK	

[Response]

RCM	0114h			
LEN	0001h			
DAT	1byte	Result		Description
		0x01	FP Cancel Success	FP Cancel success
		0x00	Fail	FP Cancel fail
CHK				

5.21 Incorrect Command

Response to host that the command is incorrect, as a result of interference effect

[Response]

RCM	0160h
LEN	0000h
CHK	

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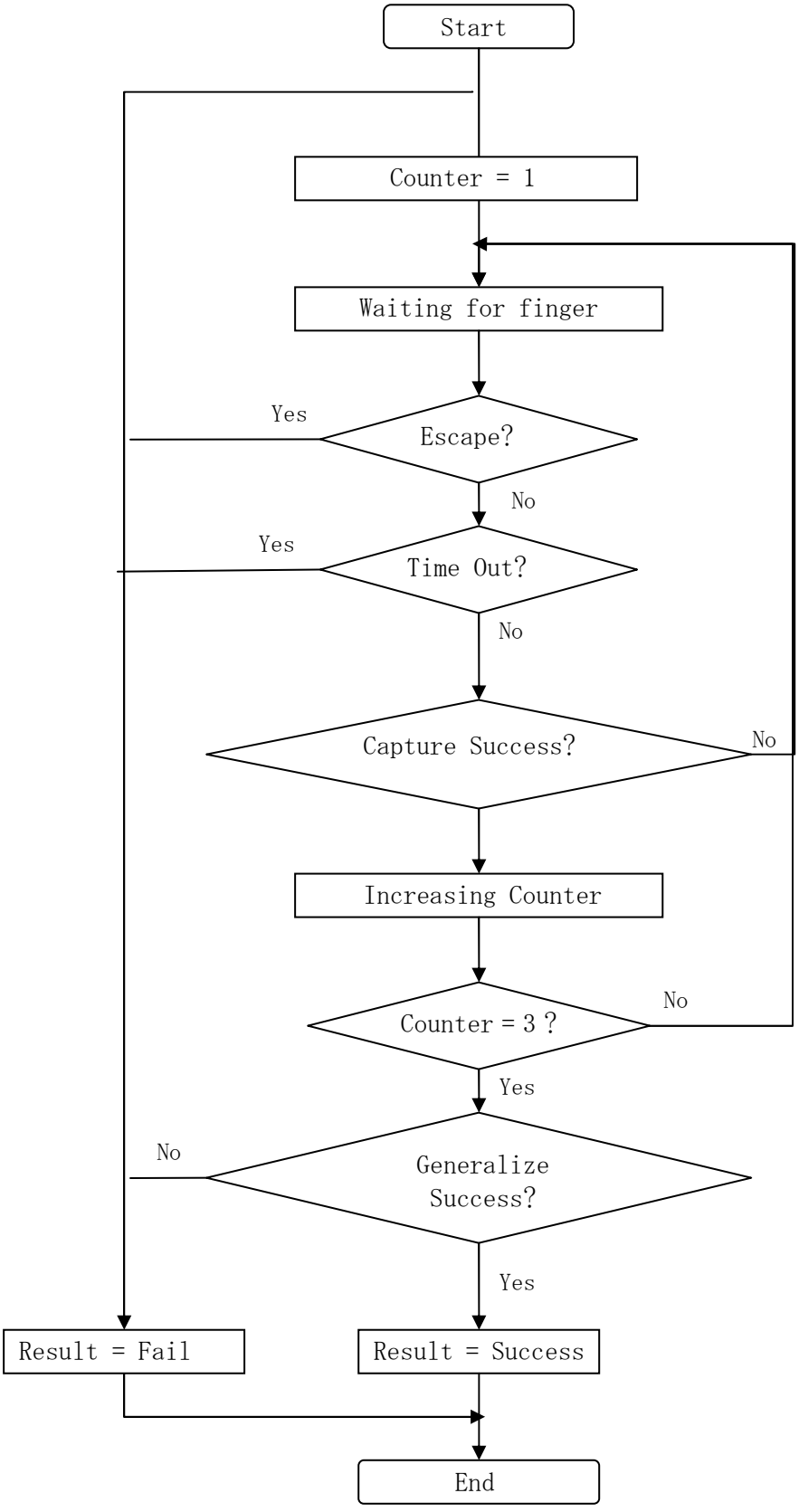
Appendix1. **Flow of Enroll process**



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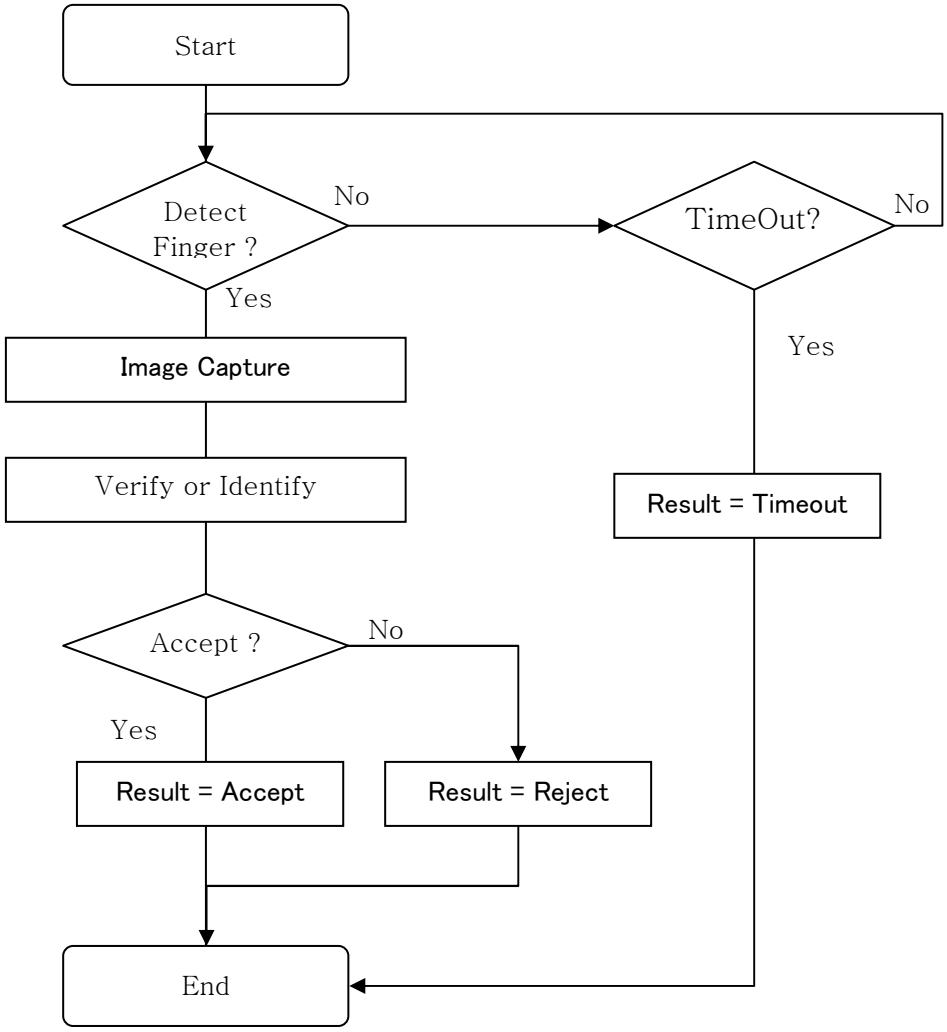
Appendix2. **The flow of Verify and Identify process**



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